CLAIMS

1. A laser beam machining method comprising a step of: irradiating laser light to a machining target while converging the light to the inside of the machining target, thereby forming a treated area based on multiphoton absorption in the machining target along a planned cutting line of the machining target and form a minute cavity at a predetermined position in connection with the treated area in the machining target.

2. The laser beam machining method according to Claim 1, further comprising a step of setting the planned cutting line.

3. A laser beam machining method comprising:

a step in which setting a planned cutting line of a machining target; and

a step in which irradiating laser light to the machining target while converging the light to the inside of the machining target, thereby forming a treated area based on multiphoton absorption in the machining target along the planned cutting line and form a minute cavity at a predetermined position in connection with the treated area in the machining target.

4. The laser beam machining method according to any one of claims 1 to 3, wherein the machining target is a semiconductor substrate, and the treated area is a molten processed area.

5. The laser beam machining method according to any one of claims 1 to 3, wherein the machining target is a semiconductor substrate, and the laser light is a pulse laser light which pulse width is set to 500 nsec or less.

6. The laser beam machining method according to any one of claims 1 to 3, wherein the machining target is a semiconductor substrate, and the laser light is a pulse laser light which pulse pitch is set to 1.00 μ m to 7.00 μ m.

7. The laser beam machining method according to any one of claims 1 to 6, wherein the minute cavities are formed along the planned cutting line, each of the minute cavities are separated.

8. The laser beam machining method according to any one of claims 1 to 7, wherein a functional element is formed on a principle surface of the machining target, and the minute cavity is located between the principle surface and the treated area.

9. The laser beam machining method according to any one of claims 1 to 8, wherein the minute cavity is formed the other side of the laser light incidence, putting the treated area between them.

10. The laser beam machining method according to any one of claims 1 to 9, further comprising a step of cutting the machining target which is formed the minute cavity.

11. A laser beam machining method comprising:

a step in which setting a planned cutting line of a semiconductor substrate; and

a step in which irradiating laser light to the semiconductor substrate while converging the light to the inside of the semiconductor substrate, thereby forming a molten processed area in the semiconductor substrate along the planned cutting line and form a minute cavity at a predetermined position in connection with the molten processed area in the semiconductor substrate.

12. A laser beam machining method comprising:

a step in which setting a planned cutting line of a semiconductor substrate; and

a step in which irradiating laser light to the semiconductor substrate while converging the light to the inside of the semiconductor substrate, thereby forming a molten processed area in the semiconductor substrate along the planned cutting line and form a minute cavity at a predetermined position in connection with the molten processed area in the semiconductor substrate, and the laser light is a pulse laser light which pulse width is set to 500 nsec or less.

13. A laser beam machining method comprising:

a step in which setting a planned cutting line of a semiconductor substrate; and

a step in which irradiating laser light to the semiconductor substrate while converging the light to the inside of the semiconductor substrate, thereby forming a molten processed area in the semiconductor substrate along the planned cutting line and form a minute cavity at a predetermined position in connection with the molten processed area in the semiconductor substrate, and the laser light is a pulse laser light which pulse pitch is set to 1.00 μ m to 7.00 μ m.

14. The laser beam machining method according to any one of claims 11 to 13, wherein the minute cavities are formed along the planned cutting line, each of the minute cavities are separated.

15. The laser beam machining method according to any one of claims 11 to 14, wherein a functional element is formed on a principle surface of the semiconductor substrate, and the minute cavity is located

between the principle surface and the treated area.

16. The laser beam machining method according to any one of claims 11 to 15, wherein the minute cavity is formed the other side of the laser light incidence, putting the molten processed area between them.

17. The laser beam machining method according to any one of claims 11 to 16, further comprising a step of cutting the machining target which is formed the minute cavity.

18. A laser beam machining apparatus comprising laser light source, a mount table for mounting a machining target, and a controller for controlling relative position of the laser light source and the mount table:

wherein the controller control relative position of the laser light source and the mount table while converging the laser light to the inside of the machining target, and the controller move the laser light source and the mount table relatively along a planned cutting line,

thereby forming a treated area based on multiphoton absorption in the machining target along the planned cutting line and form a minute cavity at a predetermined position in connection with the treated area in the machining target.

19. A laser beam machining apparatus comprising laser light source, a mount table for mounting a semiconductor substrate, and a controller for controlling relative position of the laser light source and the mount table:

wherein the controller control relative position of the laser light source and the mount table while converging the laser light to the inside

of the semiconductor substrate, and the controller move the laser light source and the mount table relatively along a planned cutting line,

thereby forming a molten processed area in the semiconductor substrate along the planned cutting line and form a minute cavity at a predetermined position in connection with the molten processed area in the semiconductor substrate.

20. A laser beam machining apparatus comprising laser light source, a mount table for mounting a semiconductor substrate, and a controller for controlling relative position of the laser light source and the mount table:

wherein the controller control relative position of the laser light source and the mount table while converging the laser light to the inside of the semiconductor substrate, and the controller move the laser light source and the mount table relatively along a planned cutting line,

thereby forming a molten processed area in the semiconductor substrate along the planned cutting line and form a minute cavity at a predetermined position in connection with the molten processed area in the semiconductor substrate, and the laser light is a pulse laser light which pulse width is set to 500 nsec or less.

21. A laser beam machining apparatus comprising laser light source, a mount table for mounting a semiconductor substrate, and a controller for controlling relative position of the laser light source and the mount table:

wherein the controller control relative position of the laser light source and the mount table while converging the laser light to the inside of the semiconductor substrate, and the controller move the laser light

source and the mount table relatively along a planned cutting line,

thereby forming a molten processed area in the semiconductor substrate along the planned cutting line and form a minute cavity at a predetermined position in connection with the molten processed area in the semiconductor substrate, and the laser light is a pulse laser light which pulse pitch is set to 1.00 μ m to 7.00 μ m.

22. The laser beam machining apparatus according to any one of claims 18 to 21, wherein the minute cavities are formed along the planned cutting line, each of the minute cavities are separated.

23. A laser beam machined product obtained by cutting a machining target by laser beam machining, comprising:

a treated area which is modified with multiphoton absorption and formed at a portion along a principal face formed by the cutting; and

a minute cavity having an opening portion formed at a predetermined position which is located on the principal face formed by cutting and corresponds to the treated area.

24. The laser beam machined product according to Claim 23, wherein the machining target is a semiconductor substrate, and the treated area is a molten processed area.

25. The laser beam machined product according to Claim 23 or Claim 24, wherein the minute cavities are formed along the planned cutting line, each of the minute cavities are separated.

26. The laser beam machined product according to Claim 25, wherein an interval of the minute cavities is 1.00 μ m to 7.00 μ m.

27. The laser beam machined product according to any one of

claims 23to 26, wherein the treated area is formed in a first zone along the planned cutting line, and the minute cavities are formed in a second zone separated from the first zone.

28. A laser beam machining method comprising a step of: irradiating laser light to a machining target while converging the l ight to the inside of the machining target, thereby forming a treat ed region which includes a treated area in the machining target al ong a planned cutting line of the machining target and form a mi nute cavity region which includes a minute cavity along at least o ne part of the planned cutting line.

29. The laser beam machining method according to Claim 28, wherein the machining target is a semiconductor substrate, and the treated area is a molten processed area.

30. A laser beam machined product obtained by cutting a machining target by laser beam machining, comprising:

a treated region which includes a treated area which is formed at a portion along a principal face formed by the cutting; and

a minute cavity region which includes a minute cavity having an opening portion formed at a predetermined position which is locat ed on the principal face formed by cutting.

31. The laser beam machined product according to Claim 30, wherein the machining target is a semiconductor substrate, and the treated area is a molten processed area.